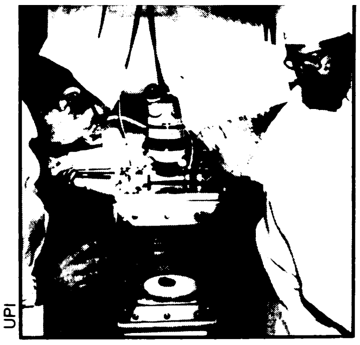
Meteorite is cold, clean, carbonaceous



UPI

Rare meteorite gets brief scrutiny.

The déjà vu was intense at the NASA Johnson Space Center in Houston last Thursday. Even as a flight team over in the Mission Control Center was preparing to maneuver Skylab for the first time in four years (see p. 388), a group of NASA officials, scientists, reporters, photographers, TV camera operators and others were clustered around a room in the nearby Lunar Curatorial Facility, home of the Apollo moonrocks. The crowd was gathered to view the opening of another sealed "rockbox," but the box did not contain a piece of the moon. Instead, it held merely a meteorite — one of thousands that have been recovered from all over the world.

The meteorite was, to be sure, a rare type: a carbonaceous chondrite, believed to represent some of the most primitive material surviving from the early solar system, and rare because the delicate objects suffer far more than stony or iron meteorites from atmospheric entry and from the effects of weathering. But carbonaceous chondrites have been found before. The real reason for the excitement was that this particular example may be the best-preserved of its kind ever found, offering an unprecedented chance to explore the mysteries of its past.

The golfball-sized rock, charcoal gray with a slight olive-green cast, is one of perhaps two carbonaceous chondrites among more than 300 meteorites gathered several months ago in Antarctica, where the intense cold would be a major factor in its preservation. Picked up with special gloves, it was placed in a refrigerated container and flown directly to JSC to await examination in a proper facility.

The meteorite facility, which was inaugurated with the container's opening last week, was made from two rooms of the moonrock facility. Working through the openings of a sealed "glovebox," researchers gingerly exposed the chunk enough for brief visual scrutiny and trimmed off a tiny sample. This was hand-delivered to meteoriticist Brian Mason of the Smithsonian Institution in Washington for detailed typing.

Mason's report makes the find more exciting still. It is a Type 2, a kind of carbonaceous chondrite relatively rich in water and carbon, suggesting that it may have formed in a relatively cool region. Notably, some Type 2s have been found in the past to contain amino acids, the building blocks of protein on earth but here more likely from nonbiologic origin (believed in part because past finds have shown both right- and left-handed isomers). The test sample shows "no evidence of internal weathering" (thus suggesting it to be a "relatively recent" fall) in its interior of fine-grained, gray matrix with 2 to 3 percent irregular, light-colored inclusions.

Details of the rock are being announced in a new "Antarctic meteorite newsletter," being sent to about 900 meteoriticists, moonrock researchers and science steering committees of member countries of the Antarctic treaty. Scientists proposing experiments with bits of the find should have their samples by September. And another possible carbonaceous chondrite from the Antarctic remains unopened. □

In and out of chromosomes

The permissive attitudes of the 1960s allowed scientists, as well as sociologists, to focus interest on "illegitimate" behaviors. In biological circles, a still titillating topic is genetic material that hops in and out of chromosomes following rules all its own. These elements seem to disregard the conservative view that chromosomes contain information in a strict sequential order. The mobile elements pop into a chromosome and alter expression of genes or cause large-scale rearrangements of adjacent DNA sequences.

Two roles for the mobile elements have been postulated. They may serve as on-off switches for nearby genes and, as such, be important in differentiation and development (SN: 3/12/77, p. 164). Or they may allow prefabrication in evolution. For example, the recent rapid evolution of plasmids that make bacteria resistant to a variety of antibiotics appears to result from plasmids acquiring several elements, each with ready-made resistance genes.

While such mobile genetic elements were recognized in maize in the 1950s by Barbara McClintock of Cold Spring Harbor Laboratory in New York, they were not identified in bacteria for many years. Now a growing catalog of mobile elements in bacteria, their plasmids and viruses has made the activity accessible to molecular biologists.

At a recent meeting at Cold Spring Harbor, researchers reported studies of the DNA sequence of mobile elements and their insertion sites. They described a puzzling finding and proposed a solution.

Many of the movable elements insert into the bacterial chromosome in a variety of different places. The simplest mobile elements, called insertion sequences, are the length of only one or two genes. The puzzle that has arisen from results at several laboratories is that an insertion sequence, when inserted in a bacterial gene, is flanked on each side by the same short DNA sequence. Yet, prior to insertion, the gene had only one copy of that stretch. How does the duplication arise?

One possibility is that the mobile element brings with it one copy of the flanking sequence, and the element only inserts next to a matching region of bacterial DNA. Michele P. Calos and Lorraine Johnsrud of Harvard University and Jeffrey H. Miller of the University of Geneva report that the insertion sequence called Is1 is flanked by different sets of 9-base pair sequences when it is inserted in two different locations. Nigel Grindley, now at the University of Pittsburgh, reports three additional sets of 9-base pair sequences for Is1 in three more locations. Thus, unless Is1 contains a region that changes sequence frequently, it is unlikely the element carries a copy of the flanking stretch.

The favored model is that DNA of the bacterial gene is cut unevenly during the insertion; breaks on the two single strands are separated by 9-base pairs. Once Is1 is in place, each side repairs, filling in the nucleotides dictated by the available single strand.

Is1 is not the only mobile element that sits within a duplication. Transposons are larger movable elements that can contain genes for drug resistance and often have copies of insertion sequences at their ends. Grindley lists four transposons that are flanked by 9-base pair sequences.

Some mobile elements sit between repeated 5-base pair, instead of 9-base pair, sequences. Eiichi Ohtsubo and co-workers described four different 5-base pair duplications around the transposon Tn3, and Grindley listed two other mobile elements with similar environments. The researchers suggest that two different bacterial enzymes make cuts staggered by 5- and 9-base pairs.

From the various analyses of the locations of transposons and insertion sequences, the researchers agree that many have neither specific target sites nor are indiscriminant in where they insert. The elements seem to prefer regions, although not exact spots. Perhaps they recognize a specific site in the DNA and insert at a nearby, but nonspecific, spot. □